

WHAT IS CLAIMED IS:

1. A fuel cell system having a fuel cell generating section comprising at least one fuel cell for generating electric power by an electrochemical reaction between a
5 fuel gas containing hydrogen and an oxidizing gas containing oxygen, fuel gas supply means for supplying a flow of fuel gas to said fuel cell generating section and oxidizing gas supply means for supplying a flow of oxidizing gas to said fuel cell generating section, wherein
10 said system further comprises a controllable electric power source, and
control means for
controlling a moisture content condition within said fuel cell generating section by adjusting said value of
15 electric current generated by said fuel cell generating section,
detecting a first condition whereby a value of total electric power generated by said system exceeds a required value and a second condition whereby said total value of
20 electric power is less than said required value, and
reducing an amount of electric power generated by said controllable electric power source when said first condition is detected and for increasing said amount of electric power generated by said controllable electric
25 power source when said second condition is detected.

2. A fuel cell system as claimed in claim 1, comprising moisture diagnosis means for diagnosing said moisture content condition of said fuel cell generating section, wherein said control means performs control of said value of electric current based upon diagnosis results obtained by said moisture diagnosis means.

3. A fuel cell system as claimed in claim 1, comprising an electrical energy storage device, wherein said control means performs control to supply a part of said electric power generated by said fuel cell generating section to be stored in said electrical energy storage device when said first condition is detected and to obtain electric power from said electrical energy storage device, to supplement said electric power generated by said fuel cell generating section, when said second condition is detected.

4. A fuel cell system as claimed in claim 2, wherein said control means comprises means for judging, based on said diagnosis results, whether a value of moisture content within said fuel cell generating section is below a predetermined lower limit, and for applying control to increase said value of electric current generated by said

fuel cell generating section when said moisture content value is found to be below said lower limit.

5 5. A fuel cell system as claimed in claim 4, wherein said control to increase said value of electric current generated by said fuel cell generating section is applied until said moisture content value is within a predetermined range of values.

10 6. A fuel cell system as claimed in claim 2, wherein said control means comprises means for judging, based on said diagnosis results, whether a value of moisture content within said fuel cell generating section exceeds a predetermined upper limit, and for applying control to
15 decrease said value of electric current generated by said fuel cell generating section when said upper limit of moisture content is found to be exceeded.

20 7. A fuel cell system as claimed in claim 4, wherein said control to decrease said value of electric current generated by said fuel cell generating section is applied until said moisture content value is within a predetermined range of values.

8. A fuel cell system as claimed in claim 2, comprising memory means having stored therein data expressing a plurality of characteristics corresponding to respectively different values of moisture content of said fuel cell generating section, each said characteristic expressing a relationship between values of electric current generated by said fuel cell generating section and corresponding values of electric power generated by said fuel cell generating section,
- 10 wherein said control means comprises means for reading out from said memory means a characteristic that is selected as corresponding to a moisture content value derived based on said diagnosis results,
- 15 when a specified value of electric current is to be generated by said fuel cell generating section, applying said specified value of electric current to obtain a corresponding value of electric power from said selected characteristic, as a value of electric power that is to be generated by said fuel cell generating section, and
- 20 when a specified value of electric power is to be generated by said fuel cell generating section, applying said specified value of electric power to obtain a corresponding value of electric current from said selected characteristic, as a value of electric current that is to
- 25 be generated by said fuel cell generating section.

9. A fuel cell system as claimed in claim 1, comprising a plurality of fuel cell generating sections each comprising at least one fuel cell, fuel gas supply means for supplying
5 a flow of fuel gas to each of said fuel cell generating sections, and oxidizing gas supply means for supplying a flow of oxidizing gas to each of said fuel cell generating sections,

wherein said system comprises moisture diagnosis means
10 for diagnosing respective moisture content conditions of said fuel cell generating sections, and

said control means comprises
means for judging results obtained by said moisture
diagnosis means to determine a one of said fuel cell
15 generating sections having a lowest value of moisture content, judging whether said lowest value of moisture content is below a predetermined lower limit value, and
when said moisture content value is found to be below said lower limit value, increasing a value of electric current
20 generated by said fuel cell generating section having the lowest value of moisture content, until said moisture content value is within a predetermined range of values,

means for judging results obtained by said moisture
diagnosis means, to determine a one of said fuel cell
25 generating sections having a highest value of moisture

content, judging whether said highest value of moisture content exceeds a predetermined upper limit value, and when said moisture content value is found to exceed said upper limit value, applying control to decrease a value of
5 electric current generated by said fuel cell generating section having the highest value of moisture content, until said moisture content value is within said predetermined range of values, and

means operating, when said control is applied to
10 increase or decrease a value of electric current generated by one of said fuel cell generating sections, to alter a value of electric current generated by at least one other of said fuel cell generating sections in a direction such as to adjust said total value of electric power towards
15 said required value of electric power.

10. A fuel cell system as claimed in claim 1, comprising a plurality of fuel cell generating sections each comprising at least one fuel cell, control means for mutually
20 separately controlling respective values of electric current generated by said fuel cell generating sections, fuel gas supply means for supplying a flow of fuel gas to each of said fuel cell generating sections along a hydrogen flow path, oxidizing gas supply means for supplying a flow
25 of oxidizing gas to each of said fuel cell generating

sections along an air flow path, and moisture diagnosis means for diagnosing respective moisture content conditions of said fuel cell generating sections;

wherein said plurality of fuel cell generating
5 sections are disposed in series along at least one of said air flow path and said hydrogen flow path, and wherein said control means controls a value of electric current produced by a first one of said fuel cell generating sections in accordance with results obtained by said moisture diagnosis
10 means for a second one of said fuel cell generating sections, said first one of the fuel cell generating sections being located upstream with respect to said second one of the fuel cell generating sections along said at least one of the air flow path and hydrogen flow path.

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11. A fuel cell system as claimed in claim 10, wherein when said control means comprises

means for judging, based on said results obtained by said moisture diagnosis means for said second one of the
20 fuel cell generating sections, whether a moisture content value for said second one of the fuel cell generating sections is below a predetermined lower limit, and means operating, when said moisture content value is found to be below said lower limit, to increase a value of electric
25 current produced by said first one of the fuel cell

generating sections, until said moisture content value for the second one of the fuel cell generating sections is within a predetermined range of values.

- 5 12. A fuel cell system having a fuel cell generating section comprising at least one fuel cell for generating electric power by an electrochemical reaction between a fuel gas containing hydrogen and an oxidizing gas containing oxygen, control means for controlling a value of
10 electric current generated by said fuel cell generating section, fuel gas supply means for supplying a flow of fuel gas to said fuel cell generating section and oxidizing gas supply means for supplying a flow of oxidizing gas to said fuel cell generating section, wherein
15 said system comprises electrical energy storage means, and
said control means comprises
means for controlling a moisture content condition within said fuel cell generating section by adjusting said
20 value of electric current generated by said fuel cell generating section,
means for detecting a first condition whereby said electric power generated by said fuel cell generating section exceeds a required value of electric power and a
25 second condition whereby said electric power generated by

said fuel cell generating section is less than said required value of electric power, and

means for applying a part of said electric power generated by said fuel cell generating section to be stored
5 in said electrical energy storage means when said first condition is detected and for obtaining electric power from said electrical energy storage means to supplement said electric power generated by said fuel cell generating section when said second condition is detected.

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13. A fuel cell system as claimed in claim 12, comprising moisture diagnosis means for diagnosing said moisture content condition of said fuel cell generating section, and wherein said control means performs control of said value
15 of electric current based upon diagnosis results obtained from diagnosing said moisture content condition.

14. A fuel cell system as claimed in claim 13, wherein said control means comprises means for judging, based on
20 said diagnosis results, whether a value of moisture content within said fuel cell generating section is below a predetermined lower limit, and for applying control to increase said value of electric current generated by said fuel cell generating section when said moisture content
25 values is found to be below said lower limit.

15. A fuel cell system as claimed in claim 14, wherein
said control to increase said value of electric current
generated by said fuel cell generating section is applied
5 until said moisture content value is within a predetermined
range of values.

16. A fuel cell system as claimed in claim 13, wherein
said control means comprises means for judging, based on
10 said diagnosis results, whether a value of moisture content
within said fuel cell generating section exceeds a
predetermined upper limit, and for applying control to
decrease said value of electric current generated by said
fuel cell generating section when said upper limit of
15 moisture content is found to be exceeded.

17. A fuel cell system as claimed in claim 16, wherein
said control to decrease said value of electric current
generated by said fuel cell generating section is applied
20 until said moisture content value is within a predetermined
range of values.

18. A fuel cell system as claimed in claim 13, comprising
memory means having stored therein data expressing a
25 plurality of characteristics corresponding to respectively

different values of moisture content of said fuel cell
generating section, each said characteristic expressing a
relationship between values of electric current generated
by said fuel cell generating section and corresponding
5 values of electric power generated by said fuel cell
generating section,

wherein said control means comprises means for
reading out from said memory means a characteristic
that is selected as corresponding to a moisture content
10 value derived based on said diagnosis results,

when a specified value of electric current is to be
generated by said fuel cell generating section, applying
said specified value of electric current to obtain a
corresponding value of electric power from said selected
15 characteristic, as a value of electric power that is to be
generated by said fuel cell generating section, and

when a specified value of electric power is to be
generated by said fuel cell generating section, applying
said specified value of electric power to obtain a
20 corresponding value of electric current from said selected
characteristic, as a value of electric current that is to
be generated by said fuel cell generating section.

19. A fuel cell system having a plurality of fuel cell
25 generating sections each comprising at least one fuel cell

for generating electric power by an electrochemical reaction between a fuel gas containing hydrogen and an oxidizing gas containing oxygen, control means for mutually separately controlling respective values of electric
5 current generated by said fuel cell generating sections, fuel gas supply means for supplying a flow of fuel gas to said fuel cell generating sections, oxidizing gas supply means for supplying a flow of oxidizing gas to said fuel cell generating sections,
10 wherein said system comprises moisture diagnosis means for diagnosing respective moisture content conditions of said fuel cell generating sections, and said control means comprises means for judging results obtained by said moisture
15 diagnosis means to determine a one of said fuel cell generating sections having a lowest value of moisture content, judging whether said lowest value of moisture content is below a predetermined lower limit value, and when said moisture content value is found to be below said
20 lower limit value, applying control to increase a value of electric current generated by said fuel cell generating section having the lowest value of moisture content, until said moisture content value is within a predetermined range of values,

judging results obtained by said moisture diagnosis means, to determine a one of said fuel cell generating sections having a highest value of moisture content, judging whether said highest value of moisture content exceeds a predetermined upper limit value, and when said moisture content value is found to exceed said upper limit value, applying control to decrease a value of electric current generated by said fuel cell generating section having the highest value of moisture content, until said moisture content value is within said predetermined range of values, and

when said control is applied to increase or decrease a value of electric current generated by one of said fuel cell generating sections, altering a value of electric current generated by at least one other of said fuel cell generating sections in a direction such as to adjust a total value of electric power generated by said plurality of fuel cell generating sections towards a required value.

20 20. A fuel cell system as claimed in claim 19, comprising memory means having stored therein data expressing a plurality of characteristics corresponding to respectively different values of moisture content of a fuel cell generating section, each said characteristic expressing a
25 relationship between values of electric current generated

by a fuel cell generating section and corresponding values of electric power generated by said fuel cell generating section,

wherein said control means comprises means for
5 reading out from said memory means a characteristic that is selected as corresponding to a moisture content value derived based on diagnosis results obtained for a fuel cell generating section,

when a specified value of electric current is to be
10 generated by said fuel cell generating section, applying said specified value of electric current to obtain a corresponding value of electric power from said selected characteristic, as a value of electric power that is to be generated by said fuel cell generating section, and

15 when a specified value of electric power is to be generated by said fuel cell generating section, applying said specified value of electric power to obtain a corresponding value of electric current from said selected characteristic, as a value of electric current that is to
20 be generated by said fuel cell generating section.

21. A fuel cell system having a plurality of fuel cell generating sections each comprising at least one fuel cell for generating electric power by an electrochemical
25 reaction between a fuel gas containing hydrogen and an

oxidizing gas containing oxygen, control means for mutually separately controlling respective values of electric current generated by said fuel cell generating sections, fuel gas supply means for supplying a flow of fuel gas to
5 said fuel cell generating sections along a hydrogen flow path, oxidizing gas supply means for supplying a flow of oxidizing gas to said fuel cell generating sections along an air flow path, and moisture diagnosis means for diagnosing respective moisture content conditions of said
10 fuel cell generating sections;

wherein said plurality of fuel cell generating sections are disposed in series along at least one of said air flow path and said hydrogen flow path, and wherein said control means controls a value of electric current produced
15 by a first one of said fuel cell generating sections in accordance with results obtained by said moisture diagnosis means for a second one of said fuel cell generating sections, said first one of the fuel cell generating sections being located upstream with respect to said second
20 one of the fuel cell generating sections along said at least one of the air flow path and hydrogen flow path.

22. A fuel cell system as claimed in claim 21, wherein when said control means judges based on said results
25 obtained by said moisture diagnosis means for said second

one of the fuel cell generating sections that a moisture content value for said second one of the fuel cell generating sections is below a predetermined lower limit, said control means applies control to increase a value of electric current that is produced by said first one of the fuel cell generating sections, until said moisture content value for the second one of the fuel cell generating sections is within a predetermined range of values.

23. A fuel cell system as claimed in claim 21, comprising memory means having stored therein data expressing a plurality of characteristics corresponding to respectively different values of moisture content of a fuel cell generating section, each said characteristic expressing a relationship between values of electric current generated by a fuel cell generating section and corresponding values of electric power generated by said fuel cell generating section,

wherein said control means comprises means for reading out from said memory means a characteristic that is selected as corresponding to a moisture content value derived based on diagnosis results obtained for a fuel cell generating section,

when a specified value of electric current is to be generated by said fuel cell generating section, applying

said specified value of electric current to obtain a corresponding value of electric power from said selected characteristic, as a value of electric power that is to be generated by said fuel cell generating section, and

- 5 when a specified value of electric power is to be generated by said fuel cell generating section, applying said specified value of electric power to obtain a corresponding value of electric current from said selected characteristic, as a value of electric current that is to
10 be generated by said fuel cell generating section.